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# Living in a dynamic landscape: prehistoric and proto-historic occupation of the northern-Netherlands coastal area

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## 1. Introduction

At first sight, the Wadden Sea area before medieval dike building would not seem to be very attractive to live in from a practical point of view. The salinity of the area and the constant threat of flooding combine to create an environment that could well be considered rather unsuited for permanent habitation. Still, people already came to live there in prehistoric times and what they did there was so successful that the area came to be one of most densely populated in north-western Europe. So, what was it that attracted the first settlers, where did they settle, how did they manage to survive, and to what extent did they influence the landscape? Archaeological research in the coastal area of The Netherlands and Germany has been focusing on these themes for many decades. This paper presents some new insights into the early occupation of the Dutch part of the coastal area.

## 2. Settling in a dynamic landscape

Circa 5000 years ago, the large tidal basins of the Boorne, the Hunze and the Fivel, former river valleys of the Pleistocene landscape, started to be filled in with sediment. This was a result of the declining relative sea level rise, combined with sufficient sediment supply. As from the Bronze Age, salt marshes were formed that gradually expanded to the north (Vos and Van Kesteren, 2000). The first inhabitants came to the area in the 6<sup>th</sup> century BC. Occupation expanded to the north, following the growing salt marsh (Vos 1999; Vos and Knol 2005). This continued well into the Early Middle Ages. After medieval dike building, deliberate land reclamation replaced natural silting up; this was only brought to a halt in the 20<sup>th</sup> century, when the coastline had reached its present form.

There were exceptions to this process of continuing growth. In some areas, massive erosion affected the landscape. At the end of the pre-Roman Iron Age, a large part of the original salt marsh between the present island of Texel and

the province of Friesland had disappeared. More to the east, the Middelzee and the Lauwerszee expanded, reaching their largest size in the Middle Ages. Finally, the Dollard came into being in the Late Middle Ages, resulting from a series of erosive events in the Ems estuary.

The salt marsh landscape was a dynamic environment. Not only did the salt marsh grow in some regions and become eroded in others, other factors contributed to its dynamics as well. The salt marshes were flooded regularly; this implied continuing sedimentation of heavy clays where water stagnated, or of more sandy deposits on the salt marsh edges, thus creating relatively high salt marsh ridges or levees (Vos, 1999). Moreover, the youngest, seawards parts of the salt marsh were relatively high compared to the older inland salt marsh, because of the continuing rising sea level. This posed a threat to the drainage of the area. There were also significant fluctuations in salinity, caused by the inflow of fresh water from nearby inland areas, while the rising groundwater level caused the formation of an extensive peat area that separated the Pleistocene inland from the coastal salt marshes. All these factors influenced human occupation of the area.

The attraction of the area to the early colonists must have been the 'nearly unlimited potentialities for grazing', as Van Zeist phrased it (1974, 333). Cattle were of major importance for the occupants of the salt marshes, as was shown from the large byres that were found, for example, in Ezinge (Waterbolk, 1991), the many bones of domestic animals (mainly cattle but also many sheep and/or goats), and the massive layers of dung often found in terps. They were not only a source of food, but also as an important factor in social life (Zimmermann, 1999). The permanent occupation of the salt marsh may have been preceded by a transhumant stage during which cattle were tended on the salt marsh during summer (Van Gijn and Waterbolk, 1984). Supporting evidence for this hypothesis was recently provided by the discovery that, on a number of locations near the city of Groningen, the vegetation had been burned

many years in succession, probably from as early as the late Bronze Age and well before permanent occupation started (Exaltus and Kortekaas, 2008). This may indicate that the dry remains of last year's vegetation were burned every spring to improve the quality of the pasture.

The colonists chose the highest parts of the salt marsh for their first settlements, especially the ridges at the seaside edges of the salt marsh. Habitation started there when a new salt marsh ridge was being formed on the seawards side, protecting the new settlement (Vos, 1999). Combined archaeological and geological research over the last two decades has shown that habitation started when the salt marsh ridge had reached the level of a middle marsh (Bazelmans, 2005, for northwestern Friesland; Nieuwhof and Vos, 2008, for northwestern Groningen). A middle marsh is defined as a marsh that is flooded several times a year, not only during winter storm floods, but also during high spring tides in summer. That implies that living on the salt marsh surface, in a Flachsiedlung, was not possible there. It was necessary to raise the living area from the start. During habitation, flooding and sedimentation continued, as can often be observed at the sides of terps (e.g. Nieuwhof and Vos, 2008).

The Flachsiedlung is part of the traditional model of the development of terp settlements. It implies that the first inhabitants settled on the surface of the high salt marsh. In time, flooding made it necessary to raise the living area: the first podia were made. These podia then coalesced, forming terps. Although this model might apply to some terps, it is probable that some of the early remains have not been recognized for what they were: small podia with all kinds of features around them in the salt marsh surface. Archaeobotanical research concentrating on surfaces from the first occupation phase could demonstrate the presence or absence of halophytes in contemporary vegetation and with that, give an indication of the frequency of flooding. However, this type of archaeobotanical research has not been executed as yet during excavations of assumed Flachsiedlungen in The Netherlands.

The early podia were usually made of salt marsh sods. Dung was also used, although there is some regional variety in its use – it is hardly ever encountered in terps in northwestern Friesland. The core of a podium usually consists of arbitrarily placed sods (e.g. in Peins, Bazelmans, 2005), sometimes of layers of clay and dung (e.g. in Leeuwarden, Nicolay, 2008), or exclusively of dung (e.g. in Englum, Nieuwhof, 2008). The podium was

consolidated with a broad lining of horizontally placed sods, as could be observed very clearly during the excavation of 2006 in Frisian Anjum (Nicolay, in press). Ditches drained the area around the podia. During habitation, the inhabitants adjusted to continuing flooding and sedimentation by raising and expanding their living area when necessary. Thus, the deepest parts of many terps are hidden by surrounding, younger sediment layers, while only a minor elevation is visible in the modern landscape. In some cases, when the population was too small or sedimentation went too fast, heightening could not keep up with sedimentation, and the terp was left. Such 'frustrated terps' were found, for example, in Paddepoel near the city of Groningen (Van Es, 1970).

A podium was only slightly larger than the house that was built on it. That implies that early settlements not only consisted of one or several houses on their podia, but also of other, so-called off-site structures on the salt marsh surface that did not need the protection of a raised area. A wide area around the settlements was used regularly for all kinds of activities. Ditches and other features such as pits were found, for example near the terp of Hoxwier (Nieuwhof and Prummel, 2007) and under younger layers in Englum (Nieuwhof, 2008).

The use of dung in podia and floors may seem strange, but was in fact a very practical choice. Dung has great insulating qualities and is thus very suitable for layers to live on, in houses and byres (Zimmermann, 1999). Used in surfaces, dung is far less slippery than clay, as many terp excavators can testify (starting with Van Giffen, 1924). Moreover, dung was not necessary for agriculture; yearly flooding of fields enriched the soil with all the necessary minerals. Experiments have shown that manuring of salt marsh fields does not necessarily result in larger yields (Van Zeist *et al.*, 1976).

Manuring brings us to one of the most difficult subjects of terp archaeology: did the landscape allow for arable farming? The brackish soil, the sea wind and the risk of flooding during germination and growing do not count as favourable conditions for growing crops. Experiments on the unprotected salt marsh have shown that it is possible to grow some crops on the sandy clays of the highest parts of the salt marsh, after the spring rains have washed away the salt (Körber-Grohne, 1967; Van Zeist *et al.*, 1976; Bottema *et al.*, 1980). Nevertheless, the experiments showed very clearly that there were many risks involved and that one could never be certain that a usable harvest

would result from all the efforts. It is difficult to conceive that people based their existence on such an uncertain outcome. Even though it might be argued that circumstances on the salt marsh were more favourable for arable farming than they are now, owing to the much larger capacity for water storage of the pre-diked salt marsh, a more reliable way of arable farming would seem to be required. Did the early inhabitants of the salt marshes protect their fields in some way?

In 1998 and 1999, excavations were executed in the terps of Dongjum-Heringa and Peins-Oost, in the northwestern part of Friesland. During both excavations, the remains of small dikes were found (Bazelmans *et al.*, 1999; Bazelmans, 2005). Their dating was surprisingly early, compared to the earliest known dikes from the Middle Ages. The dike of Dongjum was dated to the 2nd century AD, while the dike of Peins was even older, dating to the 1st century BC. Of the Dongjum-dike, only a few meters were recovered. However, the dike of Peins could be excavated over a length of 54 m, so that its structure and relation to other features could be studied relatively well. Both dikes were later covered by younger terp layers, while digging activities during habitation had destroyed the top of both dikes.

The dikes had been made in several phases and had a core of salt marsh sods placed criss-cross on the salt marsh surface. These sods were then covered with a further layer of neatly placed sods, thus creating a firm surface that could withstand flooding very well. Vegetation would have continued growing on the sods, thus contributing to the firmness of the covering layer. After the initial phases, the dike of Dongjum was enlarged one more time; the dike of Peins was enlarged at least three more times over a period of several decades, maybe even a century. This period is an estimate, based on the time it would take to form the sediment layers that were found behind the dike on its landward side. After the last phase, the dike of Peins was at least 13 m wide; its height was estimated at about 1.25 m. That implies that its slopes were rather gentle.

Knowing the basic structure, some more dikes could be recognized in older excavations, for example in Wijnaldum (Bazelmans, 2005). The phenomenon may actually not be rare at all. Of course, the first question is: what may have been the function of these dikes?

It could be established that the dikes were made on the middle salt marsh. In Peins, archaeobotanical research of a series of samples from two ditches at the foot of the dike showed that the dike

was made on a salt marsh ridge, bordering on a young, low marsh at the seaward side (Nieuwhof, 2006). During the lifetime of the dike, this part of the salt marsh gradually developed into a high marsh. The first podium was made against the slope of the dike when the marsh had developed into a high middle marsh in the first century AD. Then habitation started. This established that the dikes were created long before people actually started to live there. A remarkable feature is the thick layer of sediment behind the dikes. Apparently, the dikes were low enough to allow for occasional flooding; the dikes clearly functioned as sediment traps. Most revealing is that the thick sediment layer was worked and homogenized at some distance behind the dike; the distance would be required to turn a plough round. In Dongjum, similar evidence was found, though it was not as clear as in Peins due to later disturbances.

It may be concluded that the dikes were probably used to protect arable fields. Such a field would have to be surrounded by a dike at all sides, with a water outlet to drain the area during the summer season. Culverts made of tree trunks from the Roman Iron Age have been found in Vlaardingen in Zuid-Holland (De Ridder, 2005) and near Jemgum on the Ems (Prison, 2009). Its form might have been circular or rectangular; the straight dike fragment of Peins suggests the latter. Such fields would have been protected from most floods, except for high storm surges in winter. Each high flood would have left some sediment that enriched the soil and also heightened the field relatively fast. Archaeobotanical research revealed that grazing did not occur during the earliest stages of the dike; it started later, probably only after the first podium was made and habitation started (Nieuwhof, 2006). The same research showed that the surface directly under the dike did not contain any burned fragments. This was clearly not one of the areas where yearly burning was practiced to improve pasture. We may speculate a little and think of the damage cattle might do to crops (as they did to the crops in some of the above-mentioned experiments). Cattle were clearly not allowed to graze in the vicinity of the fields.

### 3. Early human influence on the salt marsh landscape

In the above, the early colonization of the salt marsh area was discussed. It was shown that the early inhabitants adapted to this environment in several ways, finding ways to deal with some of its more negative (from a human point of view)

characteristics while profiting from others. This section will deal with the influence of human habitation on the natural environment.

There is no evidence that hunting, fishing or collecting shellfish were major occupations of the inhabitants of the prehistoric salt marsh. Among the abundant animal bones in terps, those of wild animals (including birds, fish, and shellfish) are only a small minority. During the pre-Roman and Roman Iron Age, human occupation did not pose a direct threat to animal populations, as was the case from the Late Middle Ages (Prummel and Heinrich, 2005).

A larger impact on the environment may have been made by grazing cattle on the salt marsh vegetation. There were relatively large herds which were probably kept inside at night for safety reasons and to facilitate dung collection. They were herded on the salt marsh in daytime during summer and winter, except during flooding (Nieuwhof and Woldring, 2008). Archaeobotanical evidence (*ibid.*) shows that in some areas the diversity of the flora did not decrease during habitation, indicating that the area did not suffer from heavy grazing (Schaminée *et al.*, 1998, 99). Elsewhere, heavy grazing probably did cause a decrease of plant species (Woldring and Kleine, 2008). Burning the previous year's plant remains, which may have been practiced in some or many areas, would of course have influenced the vegetation, although it is difficult to assess in what way. It is conceivable that burning resulted in a concentration of nutrients in the soil that would stimulate a more abundant growth of specific plant species. It certainly was not practiced everywhere, as the example of Peins has shown.

Many structures, such as dikes, podia, heightening layers or wells, were made of salt marsh sods. Sods were cut in the environment of the terps. Sod cutting could be studied during excavations in the vicinity of the terp of Hoxwier (Nieuwhof and Prummel, 2007). Within several hundreds of meters from this terp, many shallow, rectangular pits were found in a salt marsh surface from the early Roman Iron Age; these were interpreted as resulting from sod cutting. The pits were usually one spade deep. That means that it was not just the soil that was dug up and used; surface sods were thought to be particularly suitable for such applications. The reason for this is probably the cohesion of surface sods, created by plant roots. In Hoxwier, it was remarkable that even during the excavation, the filling of these pits was still soft and muddy, while thin layers of vegetation remains were sometimes visible in them. This in-

dicates that these pits must have developed into wet, muddy pools that attracted specific plant species (among them reed) in the stagnating fresh water environment of Hoxwier. In a more saline environment, sod pits may have attracted species of the *Puccinellio-spergularion salinae*, that are well adapted to such circumstances. It may be concluded that sod cutting contributed to diversification of plant species.

There are basically two ways in which the inhabitants of the unprotected salt marsh directly influenced the development of the salt marsh itself, though not always intentionally. The first, as we have seen, was enhancing sedimentation with the aid of low dikes that would allow flooding in winter. This may well have been an intended effect.

The second influence turned out to be quite disastrous in some areas, such as the Middelzee and the Lauwerszee. These former salt marshes areas changed into large tidal basins, due to a combination of natural causes and human activities. One of the natural causes was the increasingly poor drainage of the salt marshes because of the ever higher salt marsh ridges that came to function as barriers for inland water. Especially in Westergo, the Middelzee functioned as a new outlet for the water of the Boorne and other small rivers. However, the effect would probably have been quite limited if human activities had not increased the impact. There are indications, for the Middelzee area as well as for the Lauwerszee area, that exploitation of the seaward margins of the peat area bordering the salt marshes influenced the landscape quite drastically. Draining and peat cutting from as early as the late pre-Roman Iron Age (Waldus *et al.*, 2005; Koopstra, 2002), and salt extraction of sub-surface peat from the early Middle Ages, caused the peat surface to subside, so that these areas came to be affected by the tides. This caused an increase of tidal volume and enlargement of tidal channels, a self-reinforcing process that resulted in erosion of the peat, improvement of drainage and enlargement of the tidal inlet of the Middelzee as well as of the Lauwerszee (Groenendijk and Vos, 2002).

#### 4. Lessons from the past

Changes of the prehistoric and early historic landscape of the Wadden Sea region do not only have historic significance. Human actions in the past influenced the landscape in many ways, for better and worse. Studying this, we may learn something about causes and effects of human activities that we can use when facing modern threats, especially the effects of increasing sea level rise.



In this respect, two insights that were derived from archaeological and geological research may be useful to us. Firstly, people living in the prehistoric salt marsh area did not fight against the sea by building ever-higher dikes, but used flooding seawater to their advantage. They used low dikes that protected arable fields in summer while allowing for flooding and the deposition of fertile sediment in winter. Such an attitude is quite strange to us, modern inhabitants of the coastal areas, who have learned to only trust our dikes. Yet, it may provide us with new and unexpected solutions to environmental problems.

Secondly, draining and cutting peat, and salt extraction from sub-surface peat made the coastal area vulnerable and resulted in great loss of land in the Middelzee and the Lauwerszee areas in the past. We should learn from that to be careful not to repeat this mistake by artificially lowering the land level by, for example, salt mining or the extraction of natural gas. This could well result in an increase of the tidal volume and erosion of the tidal flats of the Wadden Sea, an effect that will even be magnified when the sea level rise increases in line with current predictions. Erosion of the Wadden Sea will pose a serious threat to the dikes and the land behind them, and of course to the Wadden Sea ecosystem as well.

Thus, archaeology not only is a scientific area that provides interesting perspectives on human societies and human survival in the past, it also may provide useful arguments in current debates. Knowledge of the past can be helpful when dealing with the challenges of the present.

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